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drift-covered region of Nova Scotia an error has not been committed in correlating them with the beds carrying Carboniferous fossils at Riversdale and Harrington River.

Speaking for himself only, the writer does not regard the evidence yet adduced by the stratigraphers as sufficiently complete to show beyond doubt that this remarkable assemblage of plants, consisting largely of types which nowhere else in the world have been found below the Waldenburg stage or the Pottsville (Millstone Grit) of the Upper Carboniferous, existed in eastern Canada during and from Middle Devonian time. Many of the species and several of the genera are, so far as known, peculiar to and characteristic of the Upper Carboniferous. A small portion of the flora is common to the Lower Carboniferous; but very little of this element is characteristic of the latter, while a close examination of the material from St. John tends to bring into doubt the identification of the few forms published as characteristic Devonian species.

No trace of this extraordinary paleobotanical anomaly appears in the thoroughly studied magnificent section of the Devonian near the Gulf of St. Lawrence, nor have any signs of such a condition yet been found in the Devonian of eastern Maine, New York, or any other region of the world. It is a remarkable fact if a flora almost exclusively composed of characteristic Carboniferous species, most, by far, of which are typical of the Upper Carboniferous, was isolated in the region of the Bay of Fundy both in and after Middle Devonian time; but it is still more remarkable if this flora were accompanied there by a likewise isolated Carboniferous molluscan fauna. Conditions producing isolation of a land flora are not generally readily reconcilable with contemporaneous and continued isolation of the invertebrates of the same region.

As to the precise characters of the faunas of the beds in question and as to the weight of their evidence in the age determination of the formations, we are but partially informed, since the reports and opinions of the several specialists to whom the materials were communicated for examination, or whose paleontological views were solicited, have not been made public. As has already been noted, materials representing vertebrates, crustacea, polecypods, and ostracods were during several seasons gathered in some quantity and placed in the hands of experts. These reports and opinions are awaited by paleontologists and geologists alike. We are in a general way informed that all the fossils gathered are more or less distinctly indicative of Carboniferous age, all efforts to discover Devonian types in the beds being unsuccessful; and it is perhaps fair to assume that had one or more of the experts, to whom some class of fossils was sent, reported in favor of their Devonian (not to say Middle Devonian) age the stratigraphers would not have omitted mention of the fact. The circumstances attending the discussion suggest a trial at which the testimony of the faunal witnesses has not been admitted.

What is at present most needed is a thorough investigation of the faunas as well as of the floras of the terranes in question, especially in Nova Scotia. If the plants are misleading the paleobotanists to overconfidence and if we are mistaken as to the non-existence of such a remarkable flora, containing so large a proportion of Upper Carboniferous types, in the Middle Devonian and living in isolation until Upper Carboniferous time, there is no one to whom the truth means more or who realizes more fully than the paleobotanist the importance of the fact. If the testimony of the plants is false, the evidence of the faunas will correct it; and if the beds in question are Middle Devonian the fossils themselves will prove it. Let us have a thorough paleontological study of the beds, and the paleontological question will settle itself.

DAVID WHITE.

PRELIMINARY STUDIES ON THE RUSTS OF THE ASPARAGUS AND THE CARNATION: PARASITISM OF DARLUCA.

DURING the past two years, the writer has been carrying on a series of experiments at the University of Nebraska, in cooperation with the United States Department of Agriculture, in inoculations with the asparagus rust (*Puccinia asparagi* DC.) and the carnation rust (*Uromyces caryophillinus* (Sch.) Schroet).

These experiments have for the most part been conducted in the greenhouse, where there was an advantage to be derived from a partial control of the heat, light, moisture, wind, etc., especially in the control of natural infection. The inoculations have been made after the usual manner by spraying the plants and placing the spores on the moistened stems or leaves of seedlings or established plants. The first inoculations on asparagus were made December 12, 1900, with uredospores obtained from the then dead plants in the field. Spores, obtained in the field on March 28 and April 24 following, gave successful inoculations also, the uredospores having retained their vitality during the winter when protected by the unbroken epidermis of the asparagus.

The period of incubation in the greenhouse has varied from eighteen to eight days. What it is in the field has not been determined, but it probably varies there as it did in the greenhouse.

Since the rust was dependent upon its host for its food, it seemed that the conditions of heat, sunshine and moisture necessary for the growth of the asparagus ought to have some effect on the development of the rust as indicated by its period of incubation, or the time that elapsed between the time of inoculation and the first appearance of the uredospores through the ruptured epidermis of the asparagus.

In these experiments, the variation could not have been due to a lack of moisture, for at times some of the plants were often kept too wet, as indicated by the growth of algæ on the surface of the soil. The plants, of course, did not grow well, neither did the rust, the sori being small and the spores light-colored. The two factors of heat and sunshine are so closely related to each other that it would be almost an impossibility to separate them. During the spring and summer the sun was the only source of heat in the greenhouse.

When the temperature, the number of hours and the intensity of the sunlight were low during the winter months, from fourteen to seventeen days were required for the sori to appear; during the spring months, when there was a gradual increase in the number of hours of sunshine and the intensity of the sunlight, the number of days was reduced from twelve to eight. When the mean daily temperature in the greenhouse was 69° and the average hours of sunshine* were five, it required fourteen days for the sori to appear after an inoculation was made; and when the temperature increased to 76° and the number of hours of sunshine increased to 6.3, only eight days were required; the period of incubation being in each case inversely as the temperature and the hours of sunshine.

The susceptibility of the plants to inoculation depended to a large extent upon their vigor and rate of growth. Attempts were made repeatedly, not only on the asparagus but on several species of the Caryophyllaceæ, to inoculate them when they were not growing well. It was tried on repotted plants, those attacked by insects, slow-growing seedlings and mature plants, with little if any success, while out of forty-two plants which were making a vigorous growth and inoculated at the same time 37, or 90 per cent., of them produced sori.

Successful inoculations with uredospores were made on the principal varieties of the garden asparagus (*Asparagus officinalis*) and the following species grown for decorative purposes: *A. plumosus nanus, A. broussonetii* and *A. verticillatus.*

It was a difficult matter to germinate the teleutospores by the methods employed. During the spring spermogonia were produced on seedlings of *A. officinalis* in seven days, followed by æcidia. Infection from the æcidiospores was brought about by sprinkling the plants with the hose. Spermogonia were also produced on *Smilax* (*A. medeoloides*), but no æcidia.

In many instances teleutospores have followed the production of uredospores, thus giving all the stages of the asparagus rust from inoculations.

The most unexpected results have been obtained from inoculations made on the com-

* These results were obtained from the observer for the Weather Bureau at Lincoln, Nebr., and represent the time when the sun was actually shining.

mon onion (*Allium cepa*), all three stages having been produced. Mr. E. W. D. Holway reports that he collected æcidia on 'winter onions' the latter part of May and the writer collected two specimens about a month later. In each of the above instances asparagus was growing near 'winter onions.' The great similarity of the asparagus rust (*Puccinia asparagi*) and the onion rust (*P. porri*), together with the results obtained by inoculation and the æcidia recently collected on the onion, is very suggestive of the identity of the two rusts. But Klebahn* has been able to inoculate several species of *Allium*, including *A. cepa* with *Melampsora*, producing a *Cæoma* in each case, so that it appears that the *Alliums* are very susceptible to the attack of the rusts when inoculated.

The writer is conducting experiments along the same line with other liliaceous plants, but as yet results are not ready for publication.

Inoculations of a number of species of *Dianthus* and *Gypsophila* with the uredospores of the carnation rust (*Uromyces caryophyllinus* (Sch.) Schroet.) have given the same general results, so far as the effect of temperature, sunlight and susceptibility is concerned, as was obtained for the asparagus. It has been demonstrated that the carnation rust is local instead of being distributed through the plant, and that certain varieties are practically immune.

There is often associated with both the asparagus and carnation rusts another fungus (*Darluca filum* Cast.) thought to be parasitic on the rust. Some observations have led the writer to conclude that it is not parasitic on the rust and that it is not so beneficial as is generally supposed. Its saprophytic tendencies have been demonstrated by growing it on various culture media, both animal and vegetable, including bouillon-gelatine and bouillon-agar, asparagus-agar, potato, canned asparagus stems, etc. On some media it produced pycnidia in three to five days. Spores from pure cultures when inoculated on rusted asparagus gave the characteristic pycnidia with the curled masses of spores issuing from them. Only negative results have as yet been obtained on the stems of living asparagus, although it flourishes on the cooked stems, and there are strong indications that it may be parasitic on asparagus. A complete account of the work will be published later.

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* Klebahn, *Zeitschrift für Pflanzenkrankheiten*, 12: 1, 17, 1902.

*CHEMICAL INDUSTRY IN GERMANY IN 1901.**

RECENTLY published statistics of the chemical industry in Germany for the year 1901 show that it has shared in the general business depression of the Empire, though the results are less unsatisfactory than in other branches of manufacture.

Among the reasons assigned for the depression are a tendency toward overproduction, the increased cost of raw materials, the high price of coal and of labor, and proposed changes in the tariffs on many articles which enter into chemical manufacture. It is also pointed out that in the United States, in Russia, and in several other countries, there is a growing interest in this branch.

The following figures show the imports and exports for the years 1900 and 1901. The articles included are the more important drugs, pharmaceutical supplies, and dyestuffs or materials entering into the manufacture of the same:

Year.	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
	Metric tons.		*Metric tons*	
1901	1,219,889	$66,164,000	889,550	$88,298,000
1900	1,114,554	62,832,000	834,229	83,776,000

While these figures show an excess of exports over imports, and a gain in exports for the year 1901 over the preceding year, the cost of raw materials and of labor has left manufacturers but small returns for their investments.

Statistics of dividends paid by concerns engaged in this branch of manufacture during the year 1901 are not yet fully announced, but

* Consular Report from H. W. Harris, Mannheim.